Primary Examiner might be required. However, it is respectfully submitted that the present invention, as reflected by each of the independent claims pending in this application, clearly patentably distinguishes over Hoshizaki et al. and is allowable thereover. This will be discussed in detail below so as to present the arguments made during the interview.

THE REJECTIONS MADE BY THE EXAMINER

The Examiner rejected claims 12-13, 16-17, 38, 47, 49-56 and 68-71 as being anticipated by Hoshizaki et al. '530. In particular, the Examiner noted that in column 13, line 56, to column 14, line 6, Hoshizaki et al. discloses that each chamber has a separate port and is separately pressurized or evacuated with a fluid or gas to achieve the desired contour of the wafer. The Examiner thus concluded that Hoshizaki et al. inherently teaches that the pressure of each chamber is independently adjusted to achieve the desired contour of the wafer to precisely control the removal rate.

The Examiner further rejected claims 14-15, 48 and 73-86 as being unpatentable over Hoshizaki et al. '530. In particular, the Examiner took the position that it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have utilized the radial width relationship as set forth in claims 73-86, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art.

It is noted that the above rejections are similar to rejections made previously in this application, in the Office Action issued December 21, 2001. Note for example the rejections in sections 2 and 4 on pages 2 and 3 of the Office Action. Subsequent to that Office Action, Applicants conducted an interview on April 17, 2002. In that interview, agreement was reached in that the Examiner agreed that Hoshizaki et al. did not disclose or suggest the claimed invention, but indicated that a further update search might be required before issue.

Subsequent to that interview, Applicants filed a response on April 22, 2002, removing several of the claims from consideration in order to simplify the issues in this application. The arguments presented in the interview of April 17, 2002 were reflected in the response.

Subsequent to this response, the Examiner issued an Advisory Action raising a number of issues concerning support in the specification for limitations in the various independent claims. Accordingly, Applicants replied by filing a further amendment to the claims (claims 73 and 80) and by indicating how and where in the specification support is found for the limitations of each of the independent claims under consideration. This response was filed with a Request for Continued Examination and is dated June 21, 2002.

The Examiner has not now made any objections to the specification or the claims on the basis of support for the claims in the specification in the Office Action of July 24, 2002. Accordingly, it is respectfully submitted to be clear from the record that the Examiner has agreed that there is proper support for the various claim limitations of each of the independent claims pending in this application.

Lastly, before continuing to the substantive distinctions over the prior art of record, Applicants would again like to thank the Examiner for his careful consideration, but also reiterate that the distinctions between the claims of the present application and Hoshizaki et al. were discussed during the previous interview of April 17, 2002, agreed to by the Examiner as indicated in the Interview Summary of that date, presented in the response filed April 22, 2002, and discussed again in the interview of November 6, 2002. In no instance has the Examiner refuted Applicants position with respect to the distinctions between the claims of the present application and Hoshizaki et al. The Examiner raised issues regarding the support for these claims, which have been addressed and overcome. Accordingly, in the following (fourth) presentation of these distinctions between Hoshizaki et al. and the claims of the present application, the Examiner's careful consideration and response is most earnestly solicited.

CLAIMS 12-17, 38-56 AND 68-71 PATENTABLY DISTINGUISH OVER HOSHIZAKI ET AL.

Claims 12-17, 38-56 and 68-71 include independent claims 12, 38, 45, 49, 68, 70 and 71. Each of these claims refers to either independently adjustable pressures or independently

controllable pressures applied to different areas of a workpiece. Such features are neither disclosed nor suggested by Hoshizaki et al.

Thus, for example in independent claim 12, the method recites a step of pressing a workpiece against a polishing surface of a turntable to polish a surface of the workpiece by applying independently adjustable pressures to substantially concentric circular areas of the workpiece. In other words, in different concentric circular areas of the workpiece, the pressures applied to the workpiece can be independently adjustable. The language of claim 38 is slightly different, but to the same effect. Thus, different pressures are applied to different circumferential portions of a workpiece, and these pressures are independently adjustable. Claim 45 refers to this feature by referring to the pressing force being controllable and adjustable in both a central portion and an outer circumferential portion of the workpiece. The polishing pressures, further, are recited as being independently adjustable. Further, claim 49 recites a workpiece carrier wherein a first polishing pressure and a second polishing pressure are controllable independently of each other. Similar language is employed in the method claim of 68. Claim 70 recites the pressures as being controllable independently of each other. Similar language is used in claim 71.

Thus, what is common to each of the independent claims in this group is that they are referring to the pressure that is applied to the workpiece, and such pressures are independently adjustable, or independently controllable or controlled, in different areas of the workpiece.

Independent adjustability or controllability of different areas of the workpiece allows for delicate, precise control over the polishing conditions. Such control is not obtainable with the device of Hoshizaki et al. The reason for this is that the purpose of Hoshizaki et al. is overall quite different. The object of Hoshizaki et al. is to achieve a wafer with a certain contour. This difference in basic purpose results in that in Hoshizaki et al., the structure is designed so that the platen 277 will form a certain contour along its bottom surface, so as to apply that contour to the wafer being polished. However, the structure of Hoshizaki et al. does not allow for providing independently adjustable pressures in different areas of the wafer. This will be explained in detail below.

As noted, for the purpose of providing a specific shape or contour to a wafer, Hoshizaki et al. uses the platen 277. As noted in column 10, line 66, the platen 277 is made of a metal material, for example steel. Because it is made of metal, the pressure applied to the wafer in the different areas of the platen 277 are not independently adjustable, i.e., there will be a dependence on each other, because the platen is metal. For example, as illustrated in Fig. 16f, by applying a vacuum to the chamber 310 and a pressure to the chamber 312, an outer circumferential area is bowed outward while an inner circumferential area is bowed inward. This does not result in two discrete areas in which there are separate and distinct pressures applied to the corresponding areas of the wafer. Rather, it results, because the platen 277 is made of metal, in the metal forming a continuous shape that bows outward in the area 312, but then continues, along the area 312 to start to bow inward, to the outer area of the chamber 310. From the outer area of the chamber 310, the platen 277 continues to bow inward until reaching the middle point. Thus the pressure that is applied to the wafer in the area corresponding to chamber 310 is not independent of the pressure applied to the wafer in the area of chamber 312. For example, if there is a certain pressure in chamber 310, and one imagines the pressure in chamber 312 going from a higher pressure to a lower pressure than the chamber in 310, the outer contours of the area of chamber 310, at least, will change to match the shape of the contour formed by chamber 312. Thus, the pressure that, as a result, gets applied to the wafer in the area of chamber 310, is dependent upon the pressure in the other area.

In other words, because the platen is made of a metal member, and the chambers are used to change the contour of the platen, there will always be an interdependence of the pressure that is applied to the wafer from one area to the other. The pressure in different areas of the wafer or workpiece cannot be independently set by the structure of Hoshizaki et al. This arrangement is certainly acceptable in Hoshizaki et al., and desirable, because the goal of Hoshizaki et al. is to achieve a certain contour of the wafer. The goal of the present invention, by contrast, is precise controllability at different areas of the wafer. Thus, by the present invention providing a structure that allows for independent adjustability or controllability of the pressure at different parts of the wafer, a clear distinction and advantage over Hoshizaki et al. is established.

The Examiner's attention is particularly directed to column 4 of Hoshizaki et al., lines 57-59: "The pressure in the cavity causes the platen to deform, thus deforming the wafer to affect the polishing characteristics as desired by the user." Also note column 11, lines 10-12: "the face of platen 277 can be caused to flex into a concave or convex shape, thus advantageously changing the shape of the wafer 200 during polishing"; please further note column 13, line 21: "Referring now to Figs. 15a-b, a more detailed description of the use of cavity 278 to change the contour of wafer 200 will be given"; please further see column 14, line 9: "a user may advantageously change the contour of a wafer being polished." What is clear from Hoshizaki et al. is that Hoshizaki et al. controls the removal of material of a wafer by setting a desired contour for the wafer. What Hoshizaki et al. then does is to provide different pressures to different chambers of Hoshizaki et al. (e.g. chambers 310 and 312) in order to set the contour of the platen 277. The pressures in different areas of the wafer are then not independently adjustable, because the pressures on the wafer result from the contour that is rigidly fixed by the shape of the platen 277. The pressure felt in different areas of the wafer is a result of different deformations of the platen 277 being pressed against the wafer. If Hoshizaki et al. were to attempt to independently adjust the pressure on the wafer, i.e. the pressure that is felt by the wafer, by changing the pressure in one or both of the chambers 310 and 312, Hoshizaki et al. would not be able to independently adjust the pressure felt by the wafer. Rather, what would happen is that if a change was made to one area, because of the fact that platen 277 is a rigid metal member, the contour in the other area would also be affected. In other words, a change in one area is dependent upon a change in the other area. The use of the rigid platen thus results in inter-dependent pressures being felt on the wafer, even if the pressures in the chambers 310 and 312 themselves are independently adjusted.

It should be noted that by the present invention being able to apply independently adjustable or controllable pressures to different areas of the wafer, certain advantages in polishing can be achieved over a structure such as that of Hoshizaki et al. For example, the mechanical pressing of Hoshizaki et al. cannot have as precise control as with the present invention, using independently adjustable polishing pressure on the wafer in different areas of the wafer.

Further, in Hoshizaki et al. any difference in the polishing pressure in the workpiece felt in different areas of the workpiece is due to a change in shape or contour of the platen. But the pressure will also depend, because of the use of the contoured surface, to press the workpiece, on the elasticity of the polishing pad. This pad will wear and change characteristics over time, and will be replaced from time to time. This means that the pressure on the different areas of the workpiece will also change for the same contour of the rigid platen. In other words, the pressure on the workpiece in different areas of the workpiece is further inter-dependent because it also depends upon the polishing pad characteristics. This can be avoided with the present invention by being able to apply independently adjustable pressures to the different areas of the workpiece.

In the rejection, the Examiner stated that Hoshizaki et al. inherently teaches that the pressure of each chamber is independently adjusted to achieve the desired contour of the wafer. However, even if the pressure in different chambers 310 and 312 is independently adjustable, this does not result in the pressure felt by the wafer or workpiece being independently adjustable, as explained above. That is, the pressure felt by the wafer or workpiece in Hoshizaki et al. in inter-dependent, i.e. dependent on the pressure in both chambers, and not just in one or the other. Again, this is because of the use of the rigid metal platen 277 to affect the application of the pressure to the wafer.

CLAIMS 73-86 CLEARLY DISTINGUISH OVER HOSHIZAKI ET AL.

Claims 73-86 include two independent claims, claims 73 and 80. Claim 73 recites that a polishing apparatus includes a plurality of chambers formed in a top ring. Fluid pressures are supplied in the respective chambers to provide a polishing pressure to a central area and an outer circumferential area of a workpiece. Furthermore, the claim recites that a radial width of the outer circumferential area is narrower than that of the central area. Claim 80 is a method claim which requires the step of applying polishing pressure on a surface of a workpiece, wherein an area where the polishing pressure is applied is divided into a central area and an outer circumferential area of the workpiece, with a radial width of the outer circumferential area being narrower than that of the central area.

Claim 73 and 80 were amended in the Amendment and Request for Reconsideration of June 21, 2002. Such amendments were presented to attempt to address the concerns raised by the Examiner, even though it is believed that the previous language was clearly supported by the specification.

In the embodiment described with respect to Fig. 1 of the present application, for example, an annular chamber C3 provides a polishing pressure to an outer circumferential area of the workpiece that is radially narrower than that of a central area created by chamber C1.

Having a relatively narrow outer circumferential area has been found by the present inventors to provide significant advantages in controlling the polishing of the edge area and addressing the so-called edge effect. As an example of the difference the use or non-use of such a relatively narrow outer circumferential area can make, please refer to Figs. 3. In Fig. 3A, no pressurized fluid was supplied. Here it can be seen that near the edge, a particularly large amount of material is removed. When pressurized fluid is supplied only to the first chamber C1, some portion near the edge has an insufficient amount of material removed. Applying only fluid pressure to the outer chamber results in the distribution of material being removed as shown in Fig. 3C. Thus, the ability to precisely control a relatively narrow outer circumferential area can be very advantageous in providing a desired polishing to a workpiece.

Further, the so-called edge effect, where the edge of the wafer may undergo an especially high rate of material removal, has been addressed by the use of a pressing ring. However, a pressing ring only affect about 2 or 3 mm from the edge of the workpiece. With the use of a relatively narrow outer chamber as claimed, an area of 25 to 30 mm can be addressed to some extent. This area of effectiveness is common for both 200 mm and 300 mm size wafers, furthermore. There is no recognition of any such advantage or structure to provide such advantage found in Hoshizaki et al.

Hoshizaki et al. neither discloses nor suggests a radially narrower area as required by each of independent claims 73 and 80. In rejecting these claims, the Examiner referenced discrete concentric chambers 310 and 312. However, in looking at Figs. 16e and 16f, which have chambers 310 and 312, it may be seen that the distance from the center line to the membrane

member 370 is smaller, in fact, than the distance from the membrane member 370 to the outer radial extent of chamber 312. Thus, the radial width of the outer circumferential area provided by chamber 312 is in fact wider than the radial width of the central area. Thus it is clear that Hoshizaki et al. does not disclose such a feature.

Nor is there any suggestion from Hoshizaki et al. to modify the structure thereof in this manner. The Embodiment of Figs. 16e and 16f is directed toward being able to change the contour of a wafer 200. Note column 13, lines 22-23. Thus, a wafer is polished into such a contoured shape. It is for this purpose that two separate chambers 310 and 312 are provided. That is, these chambers are provided so as to be able to contour the surface of the platen 277, which will press against the wafer. This thus provides a contoured wafer. Accordingly, it may be seen that the concern of Hoshizaki et al. is to provide a certain contour on the wafer, and is not to provide an area that is relatively narrow for controlling an edge area. Rather, it is noted that Hoshizaki et al. appears to use its presser ring to deal with edge area problems. There is certainly no reason provided to one of ordinary skill in the art from Hoshizaki et al. why they would have modified the radial extent of chamber 312 to be narrower than that of chamber 310.

In the Office Action, the Examiner took the position that the radial width of chamber 312 was approximately equal to that of chamber 310, and concluded that it would have been obvious to have utilized the radial width relationship of claims 73 and 80 because it has been held discovering an optimum value of a result effective variable involves only routine skill in the art. This position by the Examiner is respectfully traversed.

The optimization of a result effective variable being obvious to one of ordinary skill in the art is only true if one of ordinary skill in the art first recognizes that variable as being a result effective variable. There is no recognition by Hoshizaki et al. that the radial width of the outer chamber is a result effective variable in which it might be desirable to optimize. The Examiner's attention is directed to the case of In re Antonie, 559 F.2d 618; 195 USPQ 6 (CCPA 1977). In that case, the court recognized that the situation in which a parameter being optimized was not recognized to be a result-effective variable was an exception to the rule that the discovery of optimum value of a variable in a known process is normally obvious. It is noted that, Hoshizaki et